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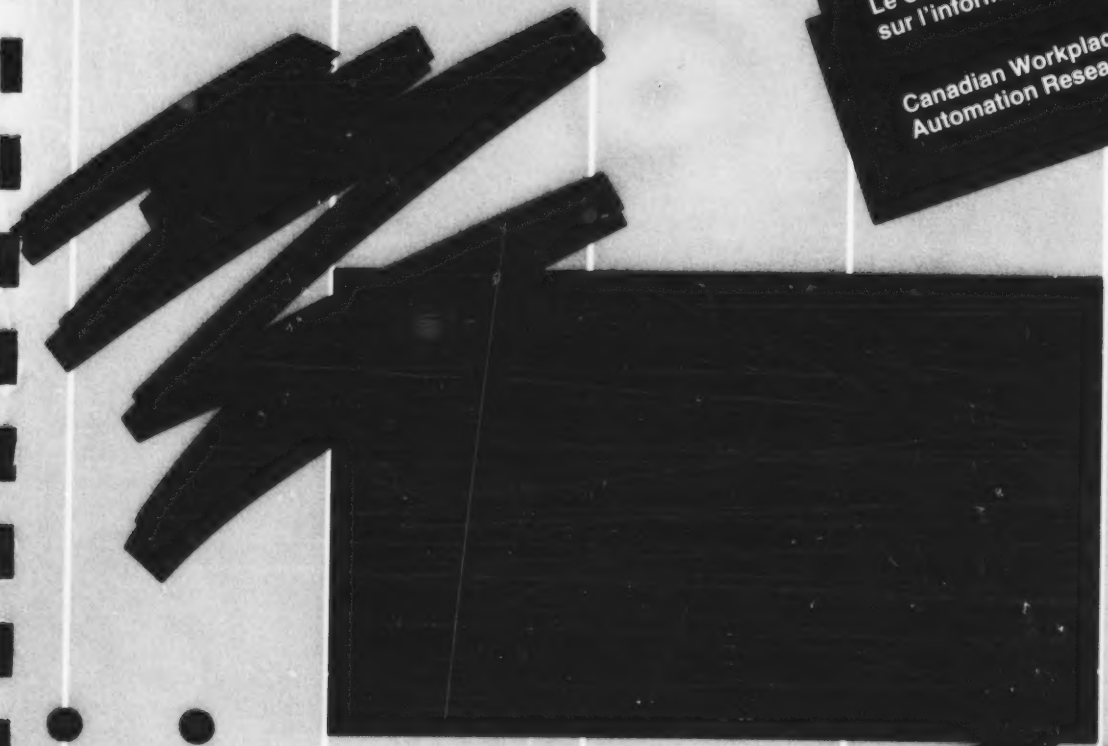

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NEW INFORMATION TECHNOLOGIES:

INNOVATION AND DIFFUSION

by

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SUMMARY

Although information has existed from time immemorial, the means of conveying opinions and information have changed considerably. We have gone from newspapers to radio, then to television and more recently to a whole range of new technologies including microcomputers. The new information products and services come from new firms that account for an ever increasing share of total economic activity.

The industry associated with such new technologies has seen the emergence of new products: text, digital data, sounds and images that can now be recorded, stored and exchanged in electronic form. The new technologies are making inroads into all sectors of the economy, and applications both at work and in the home are becoming diversified.

Along with the growth in information products and services, however, is a definite trend toward concentration, with the USA and Japan at the forefront of the international scene. For its part, Canada could carve out for itself a good position on the international technology markets in the telecommunications and new services sector.

The interrelationship between technological innovation, industrial productivity and the competitiveness of our firms on international markets is a well-known fact. Indeed, the competitiveness of our organizations seems to be increasingly linked to their ability to adopt and use effectively new information technologies.

The massive introduction of microcomputers in our firms, however, is a recent phenomenon; the years between 1983 and 1985 are generally considered to be the transition period in Canada. According to the Economic Council of Canada (1986), office automation applications (64% of all applications introduced) held centre stage with respect to technological changes in all economic sectors in Canada from 1980 to 1985 and is expected to be the main area of technological innovation from 1986 to 1990.

As a result of the progress in the areas of informatics and communications, not only have goods and services been affected but also the internal organization of our firms, relationships between the various economic players and even the very foundations of our society have altered, bringing us to a new stage: the information age.

INFORMATION TECHNOLOGIES: INNOVATION AND DIFFUSION

When one speaks of the advent of the information society, one is generally referring to the impact of new information technologies, designed to process, store, reproduce and transmit information in all fields of human endeavour. In order to shed light on the current trends, we will present a brief overview of the innovations in information diffusion, the resultant developments within organizations and factors influencing the degree of computerization.

1- Diffusion of information

1.1- Traditional means of diffusion

Although information has existed from time immemorial, the means of conveying opinions and information have changed considerably. The printed press gained undeniable supremacy in England in the early 19th century, a period which saw the emergence of the major world news agencies (Associated Press, Reuter, etc), press distributing services and most of the major newspapers. Advances in newspaper publishing technology such as offset, the invention of the telegraph, and then telecommunications technology making satellite transmission possible have each in turn radically changed the newspaper publishing industry.

The advent of radio broadcasting in the early 20th century marked another important stage in information diffusion. It led to the emergence of mass culture, the sharing of interests, values, ideas and beliefs common to the whole population. Mid-century saw the rise and growth of the news and entertainment media: television, music, film and book publishing. The market for these information industries, now described as traditional, almost tripled in Canada between 1977 and 1985 (Communications Canada, 1987).

1.2- New information technologies

In recent decades there has been an invasion of a whole range of communications technologies into our daily life: cable television, video cassettes, audio cassettes, video disks, video games, compact disk players, new types of telephone, personal computers and so forth. These new information products and services come from new firms that are taking an ever increasing share of the information market.

According to Jacques Perrin, the handling of information accounted in 1984 for 40 to 50% of the value added produced by the transborder flow of information in the industrialized nations. The industry associated with such new technologies has seen the emergence of new products: text, digital data, sounds and images that can now be recorded, stored and exchanged in electronic form.

The new products take the form of databases that provide information electronically coded in the digital language of computers. The microcomputer has maximized the possibility of immediate access to the information. As a result of developments in electronic telecommunications networks, it has become possible to query sources of electronic information, exchange computerized data and documents, carry out business transactions and so forth. Progressively, the management of information is becoming the modulus of the world economic activities (Séguin, F., 1989).

It is estimated that at the present time there are more than 3,000 databases that provide information on all sorts of subjects from the stock market to one's horoscope; increasingly they encompass all aspects of human endeavour. Indeed, new information technologies (the software and data processing industries) have grown more quickly than the GDP with revenues increasing sevenfold between 1974 and 1985, from $200 million to $2.1 billion (current dollars) (Communications Canada, 1987).

1.3- The business market

For many firms and organizations, commercial databases have come to supplement, if not replace, printed media such as newspapers, magazines and trade publications. United States play a central role in telereference in Canada, for example, a high proportion of data produced

by american owned enterprises (Visa, Howsehold Finance, etc.) are stocked in data banks located in United States.

In parallel, electronic data interchange (EDI) related to business transactions is an electronic information service that increasingly has been drawing the attention of Canadian firms. EDI, which links over 300 firms, makes it possible for firms using different computer hardware to exchange electronically business documents, to carry out business transactions and so forth (Sandy, Kemp D. A., 1987). In the wake of the free-trade agreements, trade between Canada and the United States is likely to be conducted largely through EDI ("Canada's Rapid Embrace," 1988).

The development of artificial intelligence is also having an impact on the business sector. The American business software manufacturer, McCormack and Dodge of Boston, plans to market within a year a system designed for administrative uses that will enable computers to respond to voice commands ("L'ordinateur qui entend," 1988). In the area of management information systems, it is expected that expert systems and natural language querying will become increasingly popular; among big enterprises surveyed "All of the companies were committed to highly functional and usable Management Information Systems and Executive Information Systems" (Evans Research Corporation, 1989). As a result of artificial intelligence, which makes it possible for computers to respond to voice commands, administrative uses should multiply.

1.4- The general public market

Services intended for the general public have also grown significantly: in 1984 consumer information services (teleshopping, sports news, entertainment news, electronic bulletin boards and so forth) accounted for sales of $77.8 million, or 5% of the total. Projections are that such services will generate revenues of $470 million in 1989, or 13% (Communications Canada, 1987). Examples (in the United States) of firms offering such services are CompuServe, Dow Jones News-Retrieval and The Source; the first two have more than 250,000 subscribers and the last has some 60,000.

But the most popular is unquestionably the French service Minitel, which has more than 2.5 million subscribers. In Canada, Alex (Bell Canada) was put on the market on an experimental basis in Montreal in the fall of 1988. It provides a whole range of services and electronic information including shopping, banking, lists of restaurants and cultural events, financial services and special bulletins on a 24-hour basis.

1.5- A new social organization

According to the President of Northern Telecom Ltd, Danic G. Vice, a new social and economic organization, based on telecommunications, will emerge in the 21st century. The integrated services digital network (ISDN) is an important step toward the establishment of universal networks and integrated services ("Les télécommunications à l'origine,"

1988). AT&T, British Telecom and France Telecom have just installed a transoceanic fibre optic cable between Europe and North America capable of carrying 40,000 telephone conversations simultaneously. It is proving to be a key link in the world communications network ("La fibre optique," 1989). The cable will make it possible to transmit information in the form of voice, data or video. In Canada, firms will soon be in a position to transmit business documents electronically outside the country. An agreement between AT&T and Telecom Canada will allow for transmission of business documents such as invoices and order forms ("Échanges électroniques,", 1989).

A report by the FAST group summarizes current technological changes this way:

> " New information and communication technologies have overcome time and distance. Masses of data flow across the borders in different signals -analogue or digital-and through different media -post, telex, telephone, data networks...- This development is the result of the combination of telecommunications and data processing and is clearly demonstrated by the advent of satellites of a composite type which will equally well transmit voice, messages, pictures, and sounds and provide a powerful instrument of global communication." (Communauté économique européenne, 1984)

1.6. Trend towards concentration

The phenomenal growth in information products and services has been accompanied, however, by a marked trend towards concentration, which began several years ago. For example, the 10 main makes of computers (mini and mainframe) used by Canadian firms (Canadian Information Processing Society, 1987) are all American and account for 75 to 80% of the Canadian market. IBM and Digital Equipment have dominated the market since 1975. In the case of small and medium-sized businesses (maximum annual revenue of $40 million in 1985), the most popular makes in Canada as a whole are IBM (53% of the market), Apple (8%) and Tandy-Radio-Shack (3%) (Evans Research, 1985).

On the international scene, the United States is clearly the world leader in the database industry. US database producers and vendors constitute over half the total in both on-line and gateway categories (Communications Canada, 1987). The telecommunications sector is, according to many, a field in which Canada could conceivably make a good showing on international technological markets.

1.7- The importance of telecommunications

Canada is renowned worldwide for the extent and quality of its telecommunications network. In addition to the services offered by telephone companies, telecommunications companies offer a wide range of services: CNCP (mainly transmission of text and data), Teleglobe Canada

(overseas communications) and Telesat Canada (communications by satellite) (Ministère des Communications du Québec, 1988a). This industry is characterized by a high degree of concentration.

The new cellular radiotelephone service is drastically changing the mobile telecommunications market. Two firms share this developing market: Bell Cellular, a member of CellNet Canada, and Cantel Inc., owner of a national network; they have 65,000 and 75,000 subscribers, respectively (MCQ, 1988a). Mobile telecommunications firms are planning to expand by looking for new customers among consumers and the business community (small and medium-sized businesses) mainly by offering a new range of products and services while reducing rates (MCQ, 1988b).

As regards the Canadian telecommunications equipment industry, Northern Telecom (Nortel), a subsidiary of Bell Canada Enterprises, dominates the market with sales estimated to account for 70% of total sales of telecommunications equipment in Canada. Northern Telecom is also an important player on the world market; in 1984, 75% of its sales were on the American market and 15% on the Canadian market (MCQ, 1988a).

The telecommunications equipment and communications sectors, which are growing at an annual rate of almost 11%, are a key industry for the economic development of Canada (MCQ, 1988b). According to the Quebec government, the success of the telecommunications equipment industry in Quebec and Canada is largely dependent on the growth of trade on the world market, especially with the United States.

2- Innovation within firms

2.1 Incentives and obstacles to innovation

With the production of new information goods and services, a number of studies have demonstrated the interrelationship between technological innovation, industrial productivity and competitiveness of our industries on international markets. They have pointed out the economic benefits of adopting and using new technologies with respect to productivity gains for example. Indeed, the competitiveness of our organizations seems increasingly to be linked to their ability to adopt and use effectively the new information technologies.

According to the Economic Council of Canada (ECC, 1986), in nearly 70% of Canadian firms, increased organizational productivity was the main factor behind technological changes. Managers' automation objectives rest mainly on criteria of productivity, profitability and competition. Other incentives mentioned include enhanced operational effectiveness and improved quality of products and services (ERC, 1989).

This study also contends that information and telecommunications technologies will have a major impact on the labour market and the economy in general in the years to come. It is important, therefore, to monitor the pace of diffusion and the use of new technologies but also to identify the factors of development and the obstacles to the diffusion of innovations.

Although the diffusion of technologies is generally associated with a drop in the cost of equipment, this factor is still the major obstacle to innovation for more than half the firms that participated in a survey conducted by the ECC in 1985. A shortage of qualified staff and uncertain machine performance also hamper the adoption of new technologies, especially in small and medium-sized businesses. Finally, the problems of standardizing languages and technologies constitute a deterrent for one quarter of the firms. Solving these problems should have a significant effect on the ability of firms to use new technologies.

2.2- First phase of computerization

Heavy, costly and centralized computers were the first stage of computerization (MCQ, 1988b). Before 1975, they were used exclusively by large public and private organizations, mainly for everyday operations (accounting, personnel management and so forth). This first phase was characterized mainly by the introduction of word processors (WP) and data entry terminals (DET) in offices. Most Canadian organizations are still in this first phase (Dumas, M. C., M. P. Maurice and L. Deschênes, 1989a).

According to CIPS (Canadian Information Processing Society, 1987), the number of computing facilities (excluding micros) leasing for a monthly rate exceeding $1,000 or worth a purchase price greater than $35,000 rose from 710 in 1965 to 14,503 in 1986. Almost 50% of these new technologies are used in Ontario. For example, during that period, Quebec's

share of Canadian computing facilities dropped from 29% to 16%, whereas Ontario's share remained relatively stable moving from 46% to 45%. Although the number of computers in Ontario is almost three times higher than in Quebec, the breakdown by cost of leasing is similar in the two provinces, most computers (55% or more) falling into the class that can be leased for between $1,000 and $4,999.

2.3- Second phase of computerization

The diffusion of microcomputers in the mid-seventies corresponds to a decentralized, distributed, broader form of computerization (MCQ, 1988b). The second phase of computerization in organizations meant a range of applications intended for a larger group of users. This is the phase in which informatics was applied to traditional office activities and equipment: word processing, electronic mail, records management and so forth.

The massive introduction of microcomputers in firms, however, is a recent phenomenon; the years between 1983 and 1985 are generally considered to be the transition period in Canada. According to Evans Research (1985b), 64% of small and medium-sized businesses with annual revenues greater than $40 million in 1985 had acquired their first microcomputer in 1983 or 1984; more than 75% of firms working solely with microcomputers had acquired their first microcomputer in 1984 or 1985; only 17% had made the purchase before 1984 (Lefebvre, L., É. Lefebvre and J. Ducharme, 1987). The recent popularity of

microcomputers can be explained by the lower costs but also by the fact that there are fewer problems associated with introducing such technologies.

According to the ECC (1986), office automation applications (personal computers, work stations, word processing, networks and other applications) predominated in technological innovations in firms in all economic sectors in Canada between 1980 and 1985. For example, in the first half of the 1980s, office automation technology accounted for two thirds (64%) of all applications introduced into Canadian firms. The applications adopted were the following: microcomputers and work stations (25% of applications), word processors (17%), and computers used for general administrative operations (16%). It is expected that from 1986 to 1990, office automation will remain the main form of technological innovation, accounting for 51% of all applications.

The early 1980s also saw considerable expansion in electronic mail and courier services, made possible in large part by the development of Canadian public services that meet international standards (Telecom Canada's Envoy 100 and CNCP's Dial Com). Evans Research (Chevreau, J., 1986) assessed the Canadian electronic mail market in 1985 at $15 million and estimated that the annual cumulative growth rate of 19% would double by 1989. According to Link Resources (Chevreau, J., 1986), the public electronic mail networks in the United-States generated revenues of about three hundred million dollars in 1985, this market should reach 1.5 billion dollars in 1990.

2.4- Third phase of computerization

In addition to the integration of office automation systems into Canadian firms, plans for office automation networks are expected to be carried out over the period from 1986 to 1990. About 5% of Canadian firms have integrated networks; the percentage is expected to double by 1990, according to the ECC. Advances in digitization and interconnection making possible the integration of informatics and telecommunications (telematics) and the appearance of networks (local, national and international) are associated with the third phase of computerization, which shows a marked trend towards greater integration of computerized systems.

In addition to local area networks (LAN), one can expect to see the development of public and private wide area networks (WAN) and of an integrated services digital network (ISDN) using fibre optics technology and capable of transmitting any type of message (voice, computerized data and images). Canada is expected to move towards complete digitization of its national telecommunications network, and it is in the forefront of ISDN on the international scene (Parker, E. B., 1976).

The establishment of a universal network integrating international standards should help to eliminate barriers to the exchange of information between countries. The development of networks could lead to greater, sustained growth in new related services: electronic mail, videoconferencing, remote access to databases and so forth (MCQ, 1989).

Evans Research predicts that demand will be increasingly for professional services stemming from telecommunications and informatics, which are expected to register a compound growth rate of 63% by 1990 (Communications Canada, 1987).

These developments pave the way for a fourth phase of computerization, that of distributed networks, characterized by deconcentration of processing and simultaneous multiprocessing. In addition to greater convergence between data processing and telecommunications, this phase will see voice converters, optical readers and other sophisticated equipment whose uses are still to be determined (Dumas, M.-C., M.-P. Maurice and L. Deschênes, 1989b).

2.5- Trends in software demand

When considering trends in software demand, it is important to point out that during the first phase of computerization, that is up to the mid-1970s, large private and public firms used mainly custom software. In the early 1980s the custom software sector accounted for 47% of total sales of the Canadian software industry (ERC, 1985a).

During the second phase of computerization, corresponding to the diffusion of microcomputers, the market shifted in favour of software packages: standardized software that is mass produced and intended for mass consumption. The market for this type of software has grown steadily since the early 1980s: custom software accounted for 28% of the

market in 1983, 16% in 1987 and is expected to drop to 15% in 1989, whereas the share of software packages climbed from 53% in 1981 to 83% in 1987 and should have reached 85% by 1989 (ERC, 1985a).

Development of the first sector should be sustained by the development and integration of new communications networks but also by the adaptation and modification of mass produced software. The second sector should continue to grow as microcomputers further penetrate the market and more and more small and medium-sized businesses computerize (MCQ, 1988b). The growth of the groupware sector should be important in the coming years.

2.6- Advent of telematics

The introduction of technologies related to telematics has been slower and more complex than expected, mainly because of cost, incompatibility of systems and an inadequate assessment of needs. Up to now, demand has been for gateway services and electronic mail and courier systems. The development and penetration of new professional services depend in large part on the expansion and viability of Canadian industries producing information, which seems increasingly to be the raw materials of Western economies (MCQ, 1988b).

A number of key sectors in the Canadian information industry are weak. One weak sector is the information production industry (production and publication of databases and software), in which Canadian firms--

which constitute the raw material of the major networks--hold a tiny share of their own market. Canada is lagging behind considerably: supply is low (barely 5% of the world industry) and not very diversified, and requirements are generally met outside the country. Since the mid-1980s, however, the rate of growth of our domestic markets has been comparable to that of the United States (MCQ, 1988a). The United States, for its part, is indisputably the world leader in information creation: it has 53% of the planet's databases, which accounts for almost two thirds of the world production of electronic information (MCQ, 1988b).

3- Diffusion of information technologies

3.1- Rate of diffusion

Over the past decade, the development of informatics and telecommunications applications has been an important factor in the transformation of our societies. In a context where the economic activity generated by information is greater than 50%, information industries are a growing part of the new economic structure.

But the revolution associated with information technologies is not so much the discovery per se of new technologies, which is progressive, but their applications (Faltas, 1988; Winston, 1986). The degree of penetration and diffusion of new information technologies is hard to assess because of a lack of statistical data that would make it possible to measure the degree of computerization of firms and the economy. Thus far, little analysis of the importance of the role of the information technologies industry in the social and economic development of Canada has been carried out. Hence, we have only a vague idea of the industrial and economic integration mechanisms in this industry and the characteristics of information activities. This is the result of a lack of statistics on the sector, which in turn is related to gaps in the classifications used by public and private statistics collecting bodies.

In light of these gaps, it is very difficult to find out the rate at which computerization is progressing in various economic sectors, to identify the

strengths and weaknesses of the information sector and to measure how far we are lagging behind our international competitors. According to a study conducted by the Office of Technology Assessment, "At the very moment new information technologies are transforming the economy, we are forced to rely on data that are often outmoded and outright misleading" (Kelly, H. and A. Wyckoff, 1989).

A recent study undertaken by the ECC indicates that the degree of computerization of firms is high, with 75% of firms stating that they had adopted at least one innovation based on computer technology between 1980 and 1985, and the figure is expected to reach 85% by 1990 (ECC, 1986). It is important to note, however, that the diffusion of technologies does not occur in a uniform manner. It varies considerably depending on the size of the firm, the industry and the region of the country.

3.2- Firm size

The degree of computerization varies first of all according to the size of an organization: the larger the firm, the more likely information technologies have been introduced (500 or more employees: 99% and 50 or fewer employees: 55%) (ECC, 1986). A study conducted in Quebec showed similar results: the rate of computerization in small manufacturing firms is lower than in large manufacturing firms (Lefebvre, L, Ĕ. Lefebvre and J. Ducharme, 1987).

The value of the hardware is also directly related to the size of the firm: the larger the firm, the more the computer equipment is worth (ECC, 1986). For example, in large firms (more than 500 employees) the average value of present hardware is $500,000; in medium-sized firms (from 100 to 499 employees), $300,000; and in very small firms (1 to 19 employees), $55,000. In the latter case, it is likely that microcomputers are used, as they require a lower investment. In an economy composed mainly of small and medium-sized businesses, the value of hardware plays a determinant role in the adoption of new technologies (MCQ, 1988b).

Although the larger the firm, the greater the number of applications (ECC, 1986), it seems that it is mostly small firms that plan to introduce new informatics technologies over the next few years (Lefebvre, L., É Lefebvre and J. Ducharme, 1987). Moreover, short-term purchase plans by small firms are mainly for new informatics applications related to stock management, accounting, finance and to a lesser extent personnel management, whereas large firms are mostly interested in electronic mail and records management, especially in the business sector (MCQ, 1988b).

Purchase plans show that the computerization process is far from over: in medium-sized and large firms (from 100 to 500 employees), the value of planned informatics equipment is generally as great as the value of existing equipment (MCQ, 1988b).

Small businesses in the manufacturing and business sectors are lagging behind somewhat small businesses in the service sector, a difference explained by the high cost of computerization in the two sectors and a lack of human resources (MCQ, 1988b).

Firm size also has a direct effect on the language of the software used in firms in Quebec: small firms (less than 100 employees) reported using a higher percentage of French software (50%) than larger firms (MCQ, 1988b). Taking accounting software as an example, French software is used in 50% of small firms, 37% of medium-sized firms and 30% of large firms (1987). Large firms use more English software (35%) than French software (30%) for accounting.

3.3- Economic sectors

Some firms have a higher level of computerization. For example, the degree of computerization is higher in service firms. It varies according to sector: wholesale trade (91%), communications and other public services (87%), business services (82%), finance, insurance and real estate (79%) (CEC, 1986)--or according to service offered, which itself is more or less dependent on computerization. The four most highly computerized sectors are also the ones that have opted in great numbers for office automation technologies (87%, 79%, 79% and 77%).

Some important differences were noted (ECC, 1986), in particular with respect to the adoption of office automation networks. For example, 25% of firms in the finance, insurance and real estate sector adopted office automation networks compared with 12% in the communications and other public services sector and 9% in the wholesale sector. Conversely, word processors, personal computers and office automation networks are used more in the primary and manufacturing industries.

The value of the equipment is also influenced by the economic sector, especially with respect to very small firms. For example, in the manufacturing sector, investment by very small firms is three times higher than investment by firms in other sectors. This can be explained by the relatively high initial cost of some specialized applications such as computer-assisted manufacturing (CAM) technologies. In addition, the commercial sector is the one that plans to invest the most in the acquisition of informatics equipment (MCQ, 1988b).

3.4- Region of country

Diffusion of technologies is also very different according to region of the country. The percentage of Canadian companies that introduced new technologies between 1980 and 1985 increases from east to west: Atlantic, 67%; Quebec, 71%; Ontario, 76%; and the West, 81% (ECC, 1986). Quebec and Ontario are ahead of the other provinces in terms of expenditures on informatics equipment and costs associated with production automation in the manufacturing industry (MCQ, 1988b).

If one looks at the use of computers (CROP, 1987) by persons 15 years of age or older, one also finds significant fluctuations according to region: the Atlantic Provinces have the lowest percentage of users (18%), followed by Quebec (24%), while Ontario (31%) and the Western provinces (35%) have higher rates. The percentage of people who have been using a computer for more than three years is also higher among residents of the West and Ontario (47% and 38% over against 30% and 31% in Quebec and the Atlantic Provinces). There is a considerable gap between Anglophones (42%) and Francophones (28%) (Deschênes, L, 1988).

If one looks only at the work force, one notes that in 1987, more than two Canadians out of ten (21%) used a microcomputer for their employment either occasionally (10%) or regularly (11%). The percentage of users also increases from east to west (Atlantic Provinces, 16%; Quebec, 20%; Ontario, 21%; and the West, 23%). Anglophones use microcomputers at work more than Francophones (23% over against 17%).

Among people who have microcomputers in their homes (13% in 1987, CROP), the percentage of Anglophone households is higher (15%) than the percentage of Francophone households (10%). The highest percentages are in Ontario (16%) and the West (15%). People who use computers in their homes do so mainly for work or entertainment. They are used most often for word processing.

Overall, firms in the service sector are more computerized, the rate of computerization is directly related to the size of the firm, the pace of diffusion of new technologies is much slower in small and medium-sized businesses and increase from East to West in the country, and the hardware come mostly from abroad.

4- Toward an information society

4.1- Information activities

Research undertaken so far on the national and international scene clearly points to the growing omnipresence of new information technologies. All sectors of the economy, whether manufacturing or services, are being profoundly transformed by advances in the informatics and communications sectors. Not only are goods and services affected, but also the internal organization of firms, relationships between the various economic players and even the very foundations of our society are affected.

According to the OECD, information activities (creation, processing, diffusion and infrastructure) account for between 18% and 25% of the GDP in industrialized countries and for between 27% and 41% of jobs (OECD, 1986). Growth in this industry even exceeds that in the GDP, an observation which is also true for Canada (Communications Canada, 1987). On that score, the industrialized countries are running a veritable race to get new information technologies.

Although these industries have a high export potential, it is the United States and Japan that are particularly successful in exporting; for its part, Canada has a trade deficit for most products. It goes without saying that Canada could take a greater share of the international market, especially in the sector of new services.

Many consider that the current revolution in the production, processing and distribution of information, in which the computer plays a central role, occurs in the context of the post-industrial society, while acknowledging that information is a factor of change: "By information I mean data processing in the broadest sense: the storage, retrieval, and processing of data become the essential resource for all economic and social exchanges" (Bell, D., 1981). The boundaries of the three traditional sectors (primary, secondary and tertiary) are expanded to make room for a new sector, the information sector, in which the informatics and telecommunications industries play an essential role. The underlying concept is that knowledge and information have become strategic resources and agents of transformation of the post-industrial society, which has reached a new stage: the information age.

The FAST group (CEE, 1984) is of a similar opinion: the information society is tending toward an advanced industrial society in which new information technologies would play the role of the central nervous system.

4.2- The information economy

One could probably say that we are witnessing the industrialization of the activities related to information, knowledge and data following the same basic principles as the industrial society: namely the standardization and maximization of the production of information goods and services. However, whereas the post-industrial society was capital intensive, the

information society is information intensive. In other words, information is now the raw material of the new economy and the principal factor of growth and development. "Today the return on investment in information is estimated to be approximately 15%, whereas 30 years ago it did not reach 4 or 5%. The earning power of capital, which was approximately 10 to 12%, on the other hand, has dropped to less than 4% per year. Capital is no longer the source of development and power it once was" (Lanvin, B., 1986).

The pace at which our societies are changing from economies based on the production of goods to economies built on the creation, management and diffusion of information and related services is unprecedented. The fact that information has taken on such importance has led to some consensus regarding the advent of an information economy, or at least an economic structure with a very major information component. It is in this light that the term information economy is now applied to the group of countries made up of the United States, Japan and most of the OECD countries.

In spite of the many different analyses undertaken on the subject at the international level, we still do not find a standard definition of information economy on which statistics are gathered.

Although we are being propelled toward the information society by developments in the informatics and communications technology sectors, it has proved difficult to get a clear picture of past trends and the effects of

such changes in the short and long term. By this very fact, political decision-makers and planners in the public and private sectors do not have available the relevant information to enable them to plan, co-ordinate and develop policies and programs adapted to the information sector and the new needs of Canadian society.

It is important, in light of the above, to promote economic and social research related to information activities, because this new industrial sector conditions international development in an era of greater and greater integration of informatics and communications technologies, and because this new sector is of definite strategic importance for the future of our country.

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